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NFPA 55 Compressed and Liquefied Gases in Portable Cylinders 1993 Edition

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Policy Adopted by NFPA Board of Directors on December 3, 1982

The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

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NFPA 55

Standard for the

Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Cylinders

1993 Edition

This edition of NFPA 55, *Standard for the Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Cylinders*, was prepared by the Technical Committee on Industrial and Medical Gases and acted on by the National Fire Protection Association, Inc. at its Fall Meeting held November 16-18, 1992, in Dallas, TX. It was issued by the Standards Council on January 15, 1993, with an effective date of February 12, 1993.

The 1993 edition of this document has been approved by the American National Standards Institute.

Origin and Development of NFPA 55

NFPA 55 was developed by the Industrial and Medical Gases Committee who recognized the need to provide information on the use of cylinder gases in one standard. The Compressed Gas Association assisted the project by submitting a draft that was used as the framework for the standard.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

NOTE: Membership on a Committee shall not in and of itself constitute an endorsement of the Association or any document developed by the Committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for developing documents covering the storage, transfer, and use of industrial gases. Included are the storage and handling of such gases in their gaseous or liquid phases, the installation of associated storage, piping, and distribution equipment, and operating practices. The Committee also has a technical responsibility for contributions in the same areas for medical gases and clean rooms.

Contents

NFPA 55

Standard for the

Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Cylinders

1993 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates explanatory material on that paragraph in Appendix A.

Information on referenced publications can be found in Chapter 8 and Appendix B.

Chapter 1 General

1-1 Scope.

1-1.1 This standard applies to the storage, use, and handling of compressed and liquefied gases in portable cylinders in all occupancies.

1-1.2 This standard shall not apply to:

(a) The off-site transportation of compressed gases.

NOTE: For regulations on the transportation of gases see the *Code of Federal Regulations*, 49 CFR parts 100 to 179 (Transportation) and Transportation of Dangerous Goods Regulations of Transport Canada.

(b) Storage, use, and handling of cylinders at gas manufacturer and distributor facilities.

(c) The storage, use, and handling of radioactive gases.

(d) The storage, use, and handling of medical gases at health care facilities.

NOTE: For information on storage of medical gases at health care facilities see NFPA 99, *Standard for Health Care Facilities*.

(e)* Cryogenic liquids in bulk and portable containers.

(f) Systems for gases, each containing more than 20,000 SCF (566 Sm^3) of oxygen, 3,000 SCF (85 Sm^3) of hydrogen, 5,000 SCF (142 Sm^3) of acetylene.

NOTE: For information on systems of more than 20,000 SCF (566 Sm^3) of oxygen see NFPA 50, *Standard for Bulk Oxygen Systems at Consumer Sites*. For information on systems of more than 3,000 SCF (85 Sm^3) of hydrogen see NFPA 50A, *Standard for Gaseous Hydrogen Systems at Consumer Sites*. For information on storage of more than 5,000 SCF (142 Sm^3) of acetylene see NFPA 51, *Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes*.

(g) Storage and use of more than a total of 735 lb (333 kg) water capacity [nominal 300 lb (136 kg) propane] of liquefied flammable gases.

NOTE: For information on storage and use of more than 735 lb (333 kg) water capacity [nominal 300 lb (136 kg) propane] of liquefied flammable gas see NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases*.

(h) Systems consisting of a single cylinder of oxygen and a single cylinder of fuel gas used for welding and cutting.

(i) Compressed and liquefied gases in separate storage areas in quantities less than those specified in Tables 1-1.2(a) and 1-1.2(b), except as specified elsewhere in this standard.

(j) Flammable gases used as a vehicle fuel when stored on the vehicle.

NOTE: For information see NFPA 52, *Standard for Compressed Natural Gas (CNG) Vehicular Fuel Systems* or NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases*.

(k) The handling and use of compressed or liquefied gases in laboratory work areas covered by NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*.

NOTE: The storage of gases outside of laboratory work areas are covered by this standard.

1-2 Alternate Materials and Procedures. The provisions of this standard are not intended to prevent the use of any material, method of construction, or procedure not specifically prescribed herein, provided any such alternate is acceptable to the authority having jurisdiction (*see Section 1.4*). The authority having jurisdiction shall require that sufficient evidence be submitted to substantiate any claims made regarding the safety of such alternates.

1-3 Training. Persons responsible for or working in the areas where compressed gases are produced, stored, handled, or used shall be trained in the chemical and physical properties of the materials and the appropriate emergency response.

1-4 Definitions. For the purpose of the standard, the following terms are defined.

Absolute Pressure. Pressure based on a zero reference point, the perfect vacuum, measured from this reference the standard atmospheric pressure at sea level is 14.7 psia (an absolute pressure of 101 kPa). Absolute pressure is commonly denoted as psia.

Approved. Acceptable to the "authority having jurisdiction."

NOTE: The National Fire Protection Association does not approve, inspect or certify any installations, procedures, equipment, or materials nor does it approve or evaluate testing laboratories. In determining the acceptability of installations or procedures, equipment or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization concerned with product evaluations which is in a position to determine compliance with appropriate standards for the current production of listed items.

Table 1-1.2(a) Quantities Exempt from the Requirements of This Standard in Industrial and Mercantile and Storage Occupancies

	Unsprinklered Areas		Sprinklered Areas	
	No Cabinet	Cabinet	No Cabinet	Cabinet
Toxic Gas (Health 4*)	0 SCF	20 SCF	0 SCF	40 SCF
Toxic Gas (Health 3*)				
(liquefied)	100 lb	200 lb	100 lb	200 lb
(compressed)	400 SCF	650 SCF	400 SCF	650 SCF
Pyrophoric Gas	500 SCF	500 SCF	1,500 SCF	1,500 SCF
Flammable Gas				
(liquefied)	100 lb	100 lb	100 lb	100 lb
(compressed)	400 SCF	400 SCF	400 SCF	400 SCF
Oxidizing Gas	400 SCF	400 SCF	400 SCF	400 SCF
Nonflammable Gas	1,000 SCF	1,000 SCF	2,000 SCF	2,000 SCF

*Health hazard rating in accordance with NFPA 704, *Standard System for the Identification of the Fire Hazards of Materials*

Table 1-1.2(b) Quantities Exempt from the Requirements of This Standard in Occupancies Other than Industrial, Mercantile, and Storage

Gas	Quantities
Toxic Gas (Health 4*)	0 SCF
Toxic Gas (Health 3*)	
(liquefied)	100 lb
(compressed)	400 SCF
Pyrophoric Gas	0 SCF
Flammable Gas	
(liquefied)	5 lb
(compressed)	75 SCF
Oxidizing Gas	400 SCF**
Nonflammable Gas	400 SCF

*Health hazard rating in accordance with NFPA 704, *Standard System for the Identification of the Fire Hazards of Materials*
**Unlimited for residential health care applications.

ASTM. American Society of Testing and Materials.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since jurisdictions and "approval" agencies vary as do their responsibilities. Where public safety is primary, the "authority having jurisdiction" may be a federal, state, local or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the "authority having jurisdiction." In many circumstances the property owner or his designated agent assumes the role of the "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction."

CFR. Code of Federal Regulations.

CGA. The Compressed Gas Association.

Compressed Gas (Nonliquefied). A gas, other than in solution, that in a packaging under the charged pressure is entirely gaseous at a temperature of 20°C (68°F).

Continuous Gas Detection System. A gas detection system where the instrument is maintained in continuous operation and the interval between sampling of any point does not exceed 30 minutes.

Cryogenic Liquid. A liquid having a boiling point lower than -150°F (-101°C) at 14.7 psia (an absolute pressure of 101 kPa).

Cylinder. A portable compressed gas container, fabricated to or authorized for use by the U.S. Department of Transportation (DOT), or fabricated to Transport Canada (TC) or the "Rules for the Construction of Unfired Pressure Vessels," Section VIII, ASME *Boiler & Pressure Vessel Code*.

Distributor. Any organization that repackages gases and handles compressed gas containers but does not consume compressed gases.

Existing Facilities. An existing facility storing, using, or handling compressed or liquefied gases that is not in strict compliance with this standard shall be permitted to continue in operation where such continued operation does not constitute a distinct hazard to life or adjoining property.

Fire Area. The floor area enclosed and bounded by fire walls, fire separation assemblies, or exterior walls of a building to restrict the spread of fire.

Flammable Gas. A gas that is flammable in a mixture of 13 percent or less (by volume) with air, or the flammable range with air is wider than 12 percent regardless of the lower limit, at atmospheric temperature and pressure.

Gas Manufacturer. A business that produces compressed gases or fills portable gas cylinders or containers.

Handling. Moving, connecting, or disconnecting a compressed or liquefied gas cylinder.

Hazard Rating. The numerical rating of the health, flammability, and self-reactivity hazards of the material, including its reaction with water, as defined in NFPA 704, *Standard System for the Identification of the Fire Hazards of Materials*.

Limited-Combustible. As applied to a building construction material, a material, *not complying with the definition of noncombustible material*, that, in the form in which it is used, has a potential heat value not exceeding 3500 Btu per lb (8141 kJ/kg), *and* complies with one of the following paragraphs (a) or (b). Materials subject to increase in combustibility or flame spread rating beyond the limits herein established through the effects of age, moisture, or other atmospheric condition shall be considered combustible.

(a) Materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of 1/8 in. (3.2 mm) that has a flame spread rating not greater than 50.

(b) Materials, in the form and thickness used, other than as described in (a), having neither a flame spread rating greater than 25 nor evidence of continued progressive combustion *and* of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread rating greater than 25 nor evidence of continued progressive combustion.

Liquefied Gas. A gas, other than in solution, that in a packaging under the charged pressure exists both as a liquid and a gas at a temperature of 20°C (68°F).

Material Safety Data Sheet (MSDS). Written or printed material concerning a hazardous material that is prepared in accordance with the provisions of 29 CFR 1910.1200.

Nesting. A method of securing cylinders upright in a tight mass using a contiguous three-point contact system whereby all cylinders in a group have a minimum of three contact points with other cylinders or a solid support structure (i.e., wall, railing).

Nonflammable Gas. A gas that does not meet the definition of a flammable gas.

OSHA. The Occupational Safety Health Administration of the U.S. Department of Labor.

Oxidizing Gas. A gas that can support and accelerate combustion of other materials.

Pyrophoric Gas. A gas that will spontaneously ignite in air at or below a temperature of 130°F (54.4°C).

SCF. One cubic foot of gas at 70°F (-21°C) and 14.7 psia (an absolute pressure of 101 kPa).

Shall. Indicates a mandatory requirement.

Storage. An inventory of compressed or liquefied gases in containers that are not in the process of being examined, serviced, refilled, loaded, or unloaded.

Toxic Gas. A gas having a health hazard rating of 3 or 4 as defined in NFPA 704, *Standard System for the Identification of the Fire Hazards of Materials*.

Treatment System. An assembly of equipment capable of processing a toxic gas and reducing the gas concentration to a predetermined safe level at the point of discharge from the system to the atmosphere.

Use. The consumption of a compressed or liquefied gas in a nonrecoverable manner.

User. An individual, group, or organization who utilizes the compressed or liquefied gas in a nonrecoverable manner.

Valve Outlet Caps and Plugs. Removable caps and plugs that form a gastight seal on valve outlets of certain gases and, in some cases, provide valve thread protection.

Valve Protection Device. A device attached to the neck ring or body of the cylinder for the purpose of protecting the cylinder valve from being struck or damaged from impact resulting from a fall or an object striking the cylinder.

Valve Protective Cap. A rigid, removable cover provided for compressed gas container valve protection.

Chapter 2 Storage

2-1 General Storage Requirements.

2-1.1 This chapter shall apply to the storage of all compressed and liquefied gases.

2-1.2 Storage areas shall be secured against unauthorized entry.

2-1.3 Gases shall be separated in storage in accordance with Table 2-1.5. When a gas is classified in more than one category, all compatibilities shall be checked and the most stringent separation shall be used.

2-1.4 Flammable gases shall be stored in accordance with this standard and the following:

(a) NFPA 50A, *Standard for Gaseous Hydrogen Systems at Consumer Sites*, for hydrogen at consumer sites.

(b) NFPA 51, *Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes*, for acetylene and other fuel gases used in welding, cutting, and similar applications within the scope of NFPA 51.

(c) NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases*, for butane, propane, and other gases under the scope of NFPA 58.

2-1.5* Toxic gases shall be stored in accordance with Table 2-1.5 and Chapter 3.

2-1.6 Storage Location.

2-1.6.1 Outdoor storage. Outdoor storage areas shall have a minimum of 25 percent of the perimeter open to the atmosphere. This open space shall be permitted to incorporate chain link fence, lattice construction, open block, or similar materials for the full height and width of the opening.

(a) Storage areas shall be kept clear of dry vegetation and combustible materials for a minimum distance of 15 ft (4.6 m).

Table 2-1.5 Separation of Gas Cylinders by Hazard

Gas Hazard Category	Nonflammable	Oxidizing	Flammable	Pyrophoric	Toxic
Toxic	C	20 ft*	20 ft*	20 ft*	—
Pyrophoric	C	20 ft*	20 ft*	—	20 ft*
Flammable	C	20 ft*	—	20 ft*	20 ft*
Oxidizing	C	—	20 ft*	20 ft*	20 ft*
Nonflammable	—	C	C	C	C

C- Compatible. Cylinders of these hazard ratings may be stored adjacent to each other.
* This distance shall be permitted to be reduced without limit when separated by a barrier of noncombustible materials at least 5 ft (1.5 m) high having a fire resistance rating of at least ½ hour.

Table 2-2.1 Location Preference of Flammable Gas Storage Areas

Location	Total Volume of Flammable Gas (SCF) Up to 2,500 SCF	2,501 to 5,000 SCF	In Excess of 5,000 SCF
Outdoors	I	I	I
In a Separate Building	II	II	II
In a Separate Room	III	III	III
Inside Buildings Not in a Separate Room and Exposed to Other Occupancies	IV	Not Permitted	Not Permitted

(b) Cylinders stored outside shall not be placed on the ground (earth) or on surfaces where water can accumulate.

(c) Storage areas shall be provided with physical protection from vehicle damage.

(d) Storage areas shall be permitted to be covered with canopies of noncombustible construction.

2-1.6.2 Indoor Storage. Heated indoor storage areas shall be arranged so that stored cylinders or other containers cannot be spot heated or heated above 125°F (51.7°C).

2-1.6.3 Other General Storage Requirements.

(a) When two or more compressed gases are stored in a gas cabinet, the gases shall be compatible (*see Table 2-1.5*).

(b) Spill control, drainage, and secondary containment shall not be required for the storage of compressed gases.

(c) Floors of storage areas shall be of noncombustible or limited-combustible construction.

(d) Shelves used for the storage of cylinders shall be of noncombustible construction and designed to support the weight of the cylinders stored.

(e) For separation from incompatible or combustible materials, storage of compressed gases shall be either:

1. Segregated from any incompatible or combustible materials storage by a minimum distance of 20 ft (6.1 m); or

2. Isolated from any incompatible or combustible material storage by a barrier of noncombustible material at least 5 ft (1.5 m) high having a minimum fire resistance rating of one half hour.

NOTE: For additional information on storage of cylinder gases see CGA Publication P-1, *Safe Handling of Compressed Gas in Cylinders*.

2-2 Flammable Gases.

2-2.1 The following general requirements for storage of flammable gases shall apply.

2-2.1.1 The storage location of nonliquefied flammable gases cylinders in buildings shall be determined by the total volume of flammable gas and shall be in the order of preference as indicated by Roman numerals in Table 2-2.1.

2-2.1.2 Storage of compressed flammable gases in other than industrial and storage occupancies shall not exceed the quantities listed in Table 1-1.2(b). Storage of compressed flammable gases in mercantile and business occupancies shall be limited to 400 SCF (11.3 Sm^3). Storage of liquefied flammable gases in all occupancies shall be in accordance with NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases*.

Exception: Facilities that primarily distribute gases and related equipment that are open to the public.

2-2.1.3 Electrical equipment shall conform to the provisions of NFPA 70, *National Electrical Code*,® Article 501 for Class I, Division 2 locations.

Exception: Electrical equipment in ventilated storage rooms larger than 10,000 cu ft (283 m^3), and containing 2500 SCF (70.79 Sm^3) or less of flammable gases, and with no cylinder sampling activity shall be permitted to be unclassified.

2-2.1.4 Smoking and open flames shall not be permitted in storage areas or within 20 ft (6.1 m) of storage areas.

2-2.1.5 Gas cylinders shall be stored a minimum distance of 20 ft (6.1 m) from storage of flammable and combustible liquids and solids.

2-2.1.6 Liquefied flammable gas cylinders shall be stored in the upright position or such that the pressure relief valve is in direct communication with the vapor space of the cylinder.

2-2.1.7 Storage of multiple groups of cylinders of flammable gases, each 2500 SCF (70.79 Sm^3) or less, in one fire area shall be permitted where the groups are separated by a minimum distance of 100 ft (30.5 m).

Exception: The separation distance shall be permitted to be reduced to 0 ft when separated by masonry walls with a fire resistance rating of 2 hours.

2-2.1.8 Different flammable gases shall be permitted to be stored together in a group.

2-2.2 The following requirements shall apply to the storage of flammable gases between 2501 SCF (70.82 Sm^3) and 5000 SCF (141.6 Sm^3) in any fire area:

2-2.2.1 Gas cylinders shall be stored in a room or enclosure with a minimum 1-hour fire resistance rating.

Exception: Gas cylinders shall be permitted to be stored in areas not within a 1-hour fire resistance rating where the entire building is equipped throughout with an automatic sprinkler system designed in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems. The sprinkler system protecting the gas cylinder storage, and for a distance of 25 ft (7.6 m) beyond in all directions, shall be capable of providing a sprinkler density of at least 0.30 gpm per sq ft (0.012 $m^3/min/m^2$) for any, including the most hydraulically remote, 2,500 sq ft.

2-2.2.2 Multiple groups of cylinders within one sprinklered fire area shall be permitted where the groups are separated by a minimum distance of 100 ft (30.5 m).

Exception No. 1: This distance shall be permitted to be reduced to 50 ft (15 m) in buildings protected with a sprinkler system designed for Ordinary Hazard, Group 1 occupancies or Light Hazard occupancies in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems.

Exception No. 2: This distance shall be permitted to be reduced to 25 ft (7.6 m) in buildings where the occupancy between storage areas is free of combustible materials and protected with a sprinkler system designed for Ordinary Hazard, Group 1 occupancies or Light Hazard occupancies in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems.

2-2.2.3 Gas cylinder storage rooms shall be provided with natural or mechanical ventilation designed to provide a minimum of 1 cfm per sq ft (0.3 m^3/m^2) of floor area. Ventilation systems shall discharge a minimum of 50 ft (15 m) from intakes of air handling systems, air conditioning equipment and air compressors.

2-2.3 The following requirements shall apply to the storage of greater than 5000 SCF (141.6 Sm^3) of flammable gases in any location.

2-2.3.1 Gas cylinders shall be stored in a room or enclosure with a minimum fire resistance rating of 2 hours. At least one wall of the room shall be an exterior building wall.

2-2.3.2 Gas cylinder storage rooms shall be provided with a sprinkler system design in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*. The sprinkler density of at least 0.30 gpm per sq ft (0.012 $m^3/min/m^2$) for any, including the most hydraulically remote, 2,500 sq ft (71 Sm^3) or the entire room whichever is smaller.

2-2.3.3 Gas cylinder storage rooms shall be provided with mechanical ventilation designed to provide a minimum of 1 cfm per sq ft (0.3 m^3/m^2) of floor area. Ventilation systems shall discharge a minimum of 50 ft (15 m) from intakes of air handling systems, air conditioning equipment and air compressors.

Chapter 3 Toxic Gases

3-1 General Requirements. In addition to the requirements of Chapter 2, the following specific requirements for storage of toxic gases shall apply.

3-1.1 Indoor storage areas used to store toxic gases shall be equipped with a continuous gas detection system that provides an alarm to warn of the presence of toxic gases in levels that present a hazard to life.

Exception: A continuous gas detection system shall not be required for toxic gases with a health rating of 3 when the upper range of the odor threshold limit of the gas is at a level below the Permissible Exposure Level of the gas. See Odor Thresholds for Chemicals with Established Occupational Health Standards for an odor threshold rating of gases.

3-1.2 Exhaust ventilation systems shall be installed in all indoor areas used for toxic gases.

Exception: Exhaust ventilation systems shall not be required for toxic gases with a health hazard rating of 3 when the total amount stored is less than 650 SCF (18.4 Sm^3), or 810 SCF (22.9 Sm^3) [150 lb (68 kg)] for chlorine.

3-1.3 Exhaust ventilation systems for indoor toxic gas storage shall comply with the following, except where natural ventilation prevents toxic accumulations of gases being stored.

(a) Where gas cabinets are not used, mechanical ventilation shall be operated continuously at a rate of not less than 1 cfm per sq ft (0.3 m^3/m^2) of floor area of the storage area.

Exception No. 1: Alternate engineered systems that recognize the properties of the gas being stored and approved by the authority having jurisdiction.

Exception No. 2: When the area is not occupied, the ventilation rate shall be permitted to be reduced provided ventilation is increased in the event concentrations exceed a predetermined set point below that concentration that poses a hazard to life.

(b) A manual ventilation shutoff shall be provided outside the room adjacent to the access door into the room or in a location approved by the authority having jurisdiction. The switch shall be labeled "Ventilation System Emergency Shutoff."

(c) Exhaust ventilation shall not be recirculated within a room or building.

(d) Ventilation shall not be required to be operated when no toxic gas is being stored.

3-1.4 Outdoor storage of toxic gases shall be located 75 ft (22 m) from a line of property that may be built upon, public ways, places of public assembly, and buildings not associated with the manufacture or use of the gases in storage. Such storage areas shall be secured from unauthorized access.

3-1.5 Cylinders of toxic gases while in storage and while being handled shall have valve protective devices or caps and gastight valve outlet caps or plugs in place. This shall apply to all cylinders whether full, partially full, or empty.

Exception: Cylinders being connected for use or disconnected.

3-2 Health 4 Storage Requirements. User locations storing toxic gases with an NFPA 704 health hazard rating of 4 shall meet the following requirements.

3-2.1 Storage within buildings shall be in gas cabinets or exhausted enclosures having positive exhaust ventilation.

Exception: Other means acceptable to the authority having jurisdiction that provide an equivalent level of safety.

3-2.2 When storage is not in buildings, at least one gas cabinet or exhausted enclosure shall be provided for the handling of leaking cylinders. The cabinet or enclosure shall be located within or adjacent to the outdoor storage area.

3-2.3 Gas cabinets or exhausted enclosures shall be connected to treatment systems.

3-3* Health 3 Storage Requirements. User locations storing toxic gases with an NFPA 704 health hazard rating of 3 shall have equipment to prevent leaking cylinders from escaping into the building or atmosphere on site or readily available.

3-4* Leakage Mitigation. At gas manufacturers and distributors facilities handling toxic gases having an NFPA 704 health hazard rating of 4, a containment device or other equivalent equipment, on site or readily available, that is capable of containing, controlling, processing, or mitigating leaks from compressed gas cylinders shall be permitted to be used in lieu of gas cabinets and treatment systems.

Chapter 4 Hazard Warnings

4-1 Hazard Identification.

4-1.1 Hazard identification signs shall be placed at all entrances to locations where compressed gases are produced, stored, used, or handled.

Exception: The authority having jurisdiction shall be permitted to waive this requirement where consistent with safety.

4-1.2 Signs.

(a) Signs shall not be obscured or removed. Signs shall be in English as a primary language or in symbols.

(b) Signs prohibiting smoking or open flames within 20 ft (6.1 m) shall be provided in areas where toxic, flammable, oxidizing, or pyrophoric gases are produced, handled, stored, or used.

4-2 Labeling Requirements. Individual compressed gas cylinders shall be marked or labeled in accordance with DOT and OSHA requirements.

NOTE: For information on labeling of compressed and liquefied gas cylinders see CGA C-7, *Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Containers.*

4-3 Label Maintenance. The labels applied by the gas manufacturer to identify the compressed or liquefied gas cylinder contents shall not be altered or removed by the user.

Chapter 5 Emergency Plan

5-1 Emergency Plan Requirements. Wherever liquefied or compressed gases are produced, handled, stored, or used an emergency response plan shall be prepared and updated. The plan shall be available for inspection by the authority having jurisdiction upon reasonable notice. The following information shall be included in the emergency plan (*See 29 CFR 1910.120 and 1910.1200*).

5-1.1 The type of emergency equipment available and its location.

5-1.2 A brief description of any testing or maintenance programs for the available emergency equipment.

5-1.3 An indication that hazard identification labeling is provided for each storage area.

5-1.4 Location of posted emergency response procedures.

5-1.5 Material safety data sheets (MSDS) shall be available for all gases stored on the site.

5-1.6 A list of responsible personnel who are designated and trained to be liaison personnel for the fire department. These individuals shall aid the emergency responders in pre-emergency planning; identifying where flammable, pyrophoric, oxidizing, and toxic gases are located; and accessing material safety data sheets and shall be knowledgeable in the site emergency response procedures.

5-1.7 A list of the types and quantities of compressed and liquefied gases normally at the facility.

Chapter 6 Compressed Gas Cylinders

6-1 Design and Construction. Cylinders shall be designed, fabricated, tested, and marked (stamped) in accordance with regulations of the U.S. Department of Transportation (DOT), Transport Canada (TC), or the Rules for the Construction of Unfired Pressure Vessels, Section VIII, ASME *Boiler & Pressure Vessel Code.*

6-2 Defective Cylinders. Defective cylinders shall be returned to the supplier. Suppliers shall repair the cylinder, remove it from service, or dispose of it in an approved manner.

6-3 Cylinders Containing Residual Gas. Compressed gas cylinders having residual product shall be treated as full except when being examined, serviced, or refilled by a gas manufacturer or distributor.

6-4 Valve Protective Caps. Where compressed gas cylinders are designed to accept valve protective caps, the user shall keep such caps on compressed gas cylinders at all times except when being filled or connected for use.

6-5 Valve Outlet Caps or Plugs. Where gastight valve outlet caps or plugs are provided, the user shall keep such devices on the valve outlet at all times except when compressed gas cylinders are being filled or connected for use.

6-6 Securing Cylinders. Compressed or liquefied gas cylinders in use or in storage shall be secured to prevent them from falling or being knocked over.

Exception No. 1: Compressed gas cylinders in the process of examination, servicing, and refilling.

Exception No. 2: At cylinder filling plants and distributors' warehouses, the nesting of cylinders shall be permitted to secure cylinders.

6-7 Cylinder Orientation. Compressed gas cylinders shall be permitted to be stored and used in the horizontal position.

6-8 Cylinders Exposed to Fire. Compressed gas cylinders exposed to fire shall not be used until they are requalified in accordance with the pressure vessel code under which they were manufactured.

6-9 Exposure to Electrical Circuits. Compressed gas cylinders shall not be placed where they could become a part of an electrical circuit.

6-10 Temperature Limits. Compressed gas cylinders shall not be exposed to temperatures exceeding 125°F (38°C). Cylinders shall not be subjected to direct heating to increase vapor pressure.

Exception: When cylinders are being refilled.

Chapter 7 Safety Precautions

7-1 Ignition Source Control.

7-1.1 Smoking or open flames shall not be permitted within 20 ft (6.1 m) of any area where flammable, oxidizing, pyrophoric, or toxic compressed gases are stored.

7-1.2 Where a flammable gas may be ignited by static electricity, means shall be provided to prevent a static discharge.

NOTE: For information on reducing the hazards of static electricity see NFPA 77, *Recommended Practice on Static Electricity.*

7-1.3 Electrical equipment and wiring in areas where flammable gases are produced, stored, handled, or used shall be installed in accordance with the provisions of NFPA 70, *National Electrical Code.*®

7-2 Fire Protection and Detection Systems.

7-2.1 Separate rooms and areas of buildings for use or storage of toxic or pyrophoric gases shall be protected by an automatic fire extinguishing system in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, or NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection.*

7-2.2 A fire alarm activation station or approved emergency signal device shall be installed adjacent to exit doors of buildings and outside of rooms or areas where the toxic, pyrophoric, or flammable gases are used or stored. Activation of the system shall sound a local alarm.

7-2.3 Smoke Detection. An approved, supervised smoke-detection system shall be provided in rooms or areas where flammable, pyrophoric, and toxic gases are stored indoors. Activation of the detection system shall sound a local alarm.

7-2.4 Manual alarm, emergency signal, detection, or automatic fire extinguishing systems shall be supervised by an approved central or remote station service or shall initiate an audible or visual signal at a constantly attended on-site location.

7-3 Standby Power. Where mechanical ventilation, treatment systems, temperature control, manual alarm, detection, or other electrically operated systems are required by other provisions of this standard, such systems shall be connected to a standby source of power to automatically supply electrical power in the event of loss of power from the primary source. (*See NFPA 70, Articles 700 and 701.*)

7-4 Compressed Gas Cabinets. Compressed gas cabinets shall be designed in accordance with this section. Cabinets shall meet the following requirements.

7-4.1 They shall be labeled on the front of the cabinet in red letters minimum 1 in. (2.5 m) high on contrasting background "HAZARDOUS - KEEP FIRE AWAY."

7-4.2 They shall be operated at negative pressure in relation to the surrounding area.

7-4.3 They shall be provided with self-closing limited access ports or noncombustible windows to give access to equipment controls. The average velocity of ventilation at the face of access ports or windows shall be not less than 200 ft per min (fpm) (60.7 m/min) with a minimum of 150 fpm (45.7 m/min) at any point of the access port or window.

7-4.4 They shall be provided with a treatment system to process all exhausted ventilation from the gas cabinet such that emissions are not a hazard to life. The system shall be sized to treat the total capacity of the largest toxic gas cylinder at the maximum flow rate based on controls in place.

NOTE: If toxic gas leakage is emitted to the atmosphere, regulations of EPA and state and local environmental law may also apply.

7-4.5 They shall be provided with self-closing doors.

7-4.6 They shall be constructed of not less than 12-gauge steel which shall be permitted to be coated to prevent corrosion.

7-4.7 They shall be internally sprinklered.

7-5 Emergency Equipment.

7-5.1 Breathing Apparatus. When toxic compressed gases are produced, handled, stored, or used, a minimum of two self-contained breathing apparatus shall be provided. The breathing apparatus shall be suitable for use with the material and shall be located near the immediate area in a location that provides safety to those expected to wear the apparatus. A safe area is one that is not likely to be immediately affected by the release of toxic compressed gases in the area of concern.

When the hazard presented by the gas is other than respiratory, other appropriate protective equipment shall be provided.

7-5.2 At least two employees who are trained in the use of self-contained breathing apparatus shall be available at all times the facility is in use.

Exception: With the approval of the authority having jurisdiction, where a formal arrangement has been made, the requirements of 7-5.1 and 7-5.2 shall be permitted to be met by other parties.

Chapter 8 Referenced Publications

8-1 The following documents or portions thereof are referenced within this standard and shall be considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

8-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 1991 edition

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 1990 edition

NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*, 1991 edition

NFPA 50A, *Standard for Gaseous Hydrogen Systems at Consumer Sites*, 1989 edition

NFPA 51, *Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes*, 1992 edition

NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases*, 1992 edition

NFPA 70, *National Electrical Code*, 1993 edition

NFPA 80, *Standard for Fire Doors and Fire Windows*, 1992 edition

NFPA 704, *Standard System for the Identification of the Fire Hazards of Materials*, 1990 edition

8-1.2 Other Publications.

8-1.2.1 Government Publications. U.S. Government Printing Office, 710 N. Capitol St., NW Washington, DC 20401.

Code of Federal Regulations, Title 49, Parts 171-192 and Parts 393 and 397. (Also available from the Association of American Railroads, American Railroads Bldg., 1920 L St. NW, Washington, DC 20036 and American Trucking Assns., Inc., 2201 Mill Rd., Alexandria, VA 22314.)

29 CFR 1910.120 and 1910.1200

8-1.2.2 ASME Publication. American Society of Mechanical Engineers, 345 East 47th St., New York, NY 10017.

"Rules for the Construction of Unfired Pressure Vessels," Section VIII, Division 1, ASME *Boiler & Pressure Vessel Code*, 1986, and all addenda and errata thru 1988

8-1.2.3 AIHA Publication. American Industrial Hygiene Association, P.O. Box 8390, 345 White Pond Rd., Akron, OH 44320.

Odor Thresholds for Chemicals with Established Occupational Health Standards

8-1.2.4 Transport Canada Publication. Transport Canada, Transport Canada Building, Place deVille Tower C, 21st Floor, Ottawa, ON K1A ON5 Canada.

Transportation of Dangerous Goods

Appendix A

This Appendix is not a part of the requirements of this NFPA document, but is included for information purposes only.

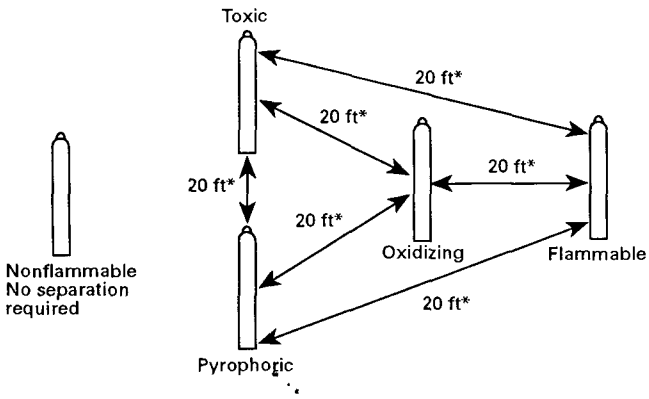
A-1-1.2(e) In developing the standard, the committee did not consider applicability to portable containers of cryogenic liquids. The committee intends to expand the document in future editions to cover these containers.

A-2-1.5 See Figure A-2-1.5.

A-3-3 Health 3 Storage Requirements. For chlorine cylinders, a kit specified by the Chlorine Institute, Inc. is available for this purpose.

A-3-4 Leakage Mitigation. The requirement for a gas cabinet connected to a treatment system is an appropriate requirement at users' locations for handling leaking toxic gas cylinders containing gases with a health hazard rating of 4. User locations incorporate cylinders both in storage and in use, where the potential for leaks is greater than at gas manufacturers and distributors storage locations for these gases.

At gas manufacturers' locations the handling of these gases is their main business, and the employees are thoroughly trained in the properties and emergency handling of these products. In fact, the majority of these locations actually house gas suppliers' emergency response teams who respond to emergencies at users' locations.



*May be reduced without limit when separated by a barrier of noncombustible materials at least 5 ft high having a fire resistant rating of at least 1/2 hour.

Figure A-2-1.5 Separation of gas cylinders by hazard.

At these locations, based on the lower risk of leaks and the more highly trained emergency response personnel, it is appropriate to allow a containment device and other equipment to be used in lieu of a gas cabinet and treatment system to handle leaking toxic gas cylinders. With the personnel on site capable of minimizing and controlling the initial stages of a leak from a site capable of minimizing and controlling the initial stages of a leak from a cylinder in storage, the proximity of a containment device within up to two hours from a storage location is considered to be readily available because most leakage rates are low and continue for many hours.

Appendix B Referenced Publications

B-1 The following documents or portions thereof are referenced within this standard for informational purposes only and thus are not considered part of the requirements of this document. The edition indicated for each reference is the current edition as of the date of the NFPA issuance of this document.

B-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 50, *Standard for Bulk Oxygen Systems at Consumer Sites*, 1990 edition

NFPA 50A, *Standard for Gaseous Hydrogen Systems at Consumer Sites*, 1989 edition

NFPA 51, *Standard for the Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes*, 1992 edition

NFPA 52, *Standard for Compressed Natural Gas (CNG) Vehicular Fuel Systems*, 1992 edition

NFPA 58, *Standard for the Storage and Handling of Liquefied Petroleum Gases*, 1992 edition

NFPA 77, *Recommended Practice on Static Electricity*, 1988 edition

NFPA 99, *Standard for Health Care Facilities*, 1993 edition

B-1.2 Other Publications.

B-1.2.1 CGA Publications. Compressed Gas Association, Inc., 1235 Jefferson Davis Highway, Arlington, VA 22202.

CGA P-1 1991, *Safe Handling of Compressed Gases in Containers*

CGA C-7 1983, *Guide to the Preparation of Precautionary Labeling and Marking of Compressed Gas Containers*

B-1.2.2 U.S. Government Publications. U.S. Government Printing Office, 710 N. Capitol St. NW Washington, DC 20401.

Code of Federal Regulations, Title 49, Parts 100-179, 171-192, and Parts 393 and 397. (Also available from the Association of American Railroads, American Railroads Bldg., 1920 L St. N.W., Washington, DC 20036 and American Trucking Assns., Inc., 2201 Mill Rd., Alexandria, VA 22314.)

29 CFR 1910.120 and 1910.1200

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SUBMITTING PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Contact NFPA Standards Administration for final date for receipt of proposals on a specific document.

Note: All proposals must be received by 5:00 p.m. E.S.T./E.D.S.T. on the published proposal closing date.

INSTRUCTIONS

Use a separate proposal form for submitting each proposed amendment.

1. Type or print legibly in black ink.

2. Indicate the number, edition year, and title of the document. Also indicate the specific section or paragraph that the proposed amendment applies to.

3. Check the appropriate box to indicate whether this proposal recommends adding new text, revising existing text, or deleting text.

4. In the space identified as "Proposal" indicate the exact wording you propose as new or revised text, or the text you propose be deleted.

5. In the space titled "Statement of Problem and Substantiation for Proposal" state the problem which will be resolved by your recommendation and give the specific reason for your proposal. Include copies of test results, research papers, fire experience, or other materials that substantiate your recommendation.

6. Check the appropriate box to indicate whether or not this proposal is original material, and if it is not, indicate the source of the material.

7. Sign the proposal.

If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee. The technical committee is authorized to abstract the "Statement of Problem and Substantiation for Proposal" if it exceeds 200 words for publication in the Technical Committee Reports.

NOTE: The NFPA Regulations Governing Committee Projects in Paragraph 10-10 state: Each proposal shall be submitted to the Council Secretary and shall include:

(a) identification of the submitter and his affiliation (Committee, organization, company) where appropriate, and

(b) identification of the document, paragraph of the document to which the proposal is directed, and

(c) a statement of the problem and substantiation for the proposal, and

(d) proposed text of proposal, including the wording to be added, revised (and how revised), or deleted.

FORM FOR PROPOSALS ON NFPA TECHNICAL COMMITTEE DOCUMENTS

Mail to: Secretary, Standards Council
National Fire Protection Association, 1 Batterymarch Park, Quincy, Massachusetts 02269-9101
Fax No.: 617-770-3500

Note: All proposals must be received by 5:00 p.m. E.S.T./E.D.S.T. on the published proposal closing date.

Date 5/18/85 **Name** John B. Smith **Tel. No.** 617-555-1212

Address 9 Seattle St., Seattle, WA 02255

Representing (Please indicate organization, company or self) Fire Marshals Assn. of North America

1. a) **Document Title:** Protective Signaling Systems **NFPA No. & Year** NFPA 72D

   b) **Section/Paragraph:** 2-7.1 (Exception)

FOR OFFICE USE ONLY
Log #:
Date Rec'd:
Proposal #:

2. **Proposal recommends: (Check one)** ☐ new text
   ☐ revised text
   ☒ deleted text.

3. **Proposal (include proposed new or revised wording, or identification of wording to be deleted):**

   Delete exception.

4. **Statement of Problem and Substantiation for Proposal:**

   A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a "trouble" signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

5. ☒ **This Proposal is original material.**
   ☐ **This Proposal is not original material; its source (if known) is as follows:** _____

(Note: Original material is considered to be the submitter's own idea based on or as a result of his own experience, thought, or research and, to the best of his knowledge, is not copied from another source.)

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John B. Smith

Signature (Required)

PLEASE USE SEPARATE FORM FOR EACH PROPOSAL